

What is claimed is

1. An amplifier characterized by gain and output power comprising:
  - (i) at least one gain medium;
  - 5 (ii) at least one pump supplying optical power into said gain medium;
  - (iii) a controller controlling said gain and said output power of said amplifier, said controller including a signal compression circuit to cover a wide dynamic range for optical input and output signals, so that resolution for low optical signals is better than resolution for high optical signals.
- 10 2. The amplifier according to claim 1, wherein said gain medium includes at-least one coil of rare earth doped fiber.
3. The amplifier of claim 1, wherein said controller utilizes a logarithmic circuit.
- 15 4. The amplifier of claim 1, wherein said controller electronic gain switch circuit.
5. The amplifier of claim 2, wherein said controller utilizes a logarithmic circuit.
- 20 6. The amplifier of claim 2, wherein said controller electronic gain switch circuit.
7. The amplifier of claim 1, wherein said controller utilizes at least two feedback loops, one of said loops being a fast loop and another one of said feedback loops being a slow loop, wherein said slow loop operates in the range of 1 Hz to 10 kHz, and said fast loop operates in the range of 500KHz to 10Mhz.
- 25 8. The amplifier of claim 7, wherein said fast loop is pump power control loop, and said slow loop is pump temperature control loop.
- 30 9. The amplifier of claim 8, said slow loop is also temperature control loop of rare-earth doped fiber.

10. The amplifier of claim 1, wherein said controller utilizes only a slow control loop, said slow control operating in the range of 1-1000 Hz, and does not control power transients.
- 5 11. An amplifier characterized by gain and output power comprising:  
(i) gain medium including rare earth-doped fiber;  
(ii) a pump supplying optical power into said gain medium;  
(iii) a controller controlling said gain and said output power of said amplifier,  
said controller including an electronic gain switch to cover a wide dynamic  
10 range for optical input and output signals, so that resolution for low optical signals is better than resolution for high optical signals.
12. The amplifier of claim 11, wherein said controller includes (i) an A/D converter, and (ii) an electronic gain switch, said electronic gain switch detects the level of  
15 electrical signal corresponding to optical signal level and, when said electrical signal is lower than a predetermined amount, and multiplies that signal by a predetermined constant, providing this multiplied signal to A/D converter.
13. The amplifier of claim 11, wherein said controller includes (i) an A/D converter, and (ii) an electronic gain switch, said gain switch said electronic gain switch  
20 detects the level of electrical signal corresponding to optical signal level and, when said electrical signal is higher than a predetermined amount for a predetermined period of time, and lowers the electronic gain, provided by the electronic gain switch, so that the input to the A/D converter stays within its range, thereby  
25 preventing an overflow condition.
14. An amplifier according to claims 2, 4 and 13, wherein said electronic gain switch includes a circuit that utilizes hysteresis to prevent unwanted electronic gain switch  
30 oscillation.
15. The amplifier of claim 1, furthers comprising A/D converter that can convert multiple analog signals simultaneously into multiple digital signals.

16. The amplifier of claim 15, wherein one of said analog signals corresponds to optical input power and the other one of said analog signals corresponds to the optical output power.

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17. The amplifier of claim 1, wherein said controller incorporates an automatic gain control, coil temperature and pump temperature control system and a communication/alarm processing system.

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